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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/676,936	10/01/2003	Vincent A. White	GP-302531	7848
7590	06/14/2004		EXAMINER	NGUYEN, TU MINH
CHRISTOPHER DEVRIES General Motors Corporation Legal Staff, Mail Code 482-C23-B21 P.O. Box 300 Detroit, MI 48265-3000			ART UNIT	PAPER NUMBER
3748				
DATE MAILED: 06/14/2004				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/676,936	WHITE ET AL.
	Examiner	Art Unit
	Tu M. Nguyen	3748

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on ____.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) Claim(s) ____ is/are allowed.
- 6) Claim(s) 1-16 is/are rejected.
- 7) Claim(s) ____ is/are objected to.
- 8) Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 01 October 2003 is/are: a) accepted or b) objected to by the Examiner. Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a). Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. ____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date: ____
3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date: ____	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
	6) <input type="checkbox"/> Other: ____

DETAILED ACTION

Drawings

1. The drawings are objected to because:

- Reference character “20” has been used to designate both “control system” and “oxygen sensor”. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

- In Figure 3, “SULFER” should read --SULFUR--.

Correction is required.

Claim Objections

2. Claim 7 is objected to because on line 4 of the claim, --and-- should be inserted following “sensor;”. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 4-12, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Bush et al. (U.S. Patent 5,842,340).

Re claims 1 and 7, as illustrated in Figures 1 and 4-7, Bush et al. disclose a method of controlling equivalence ratio in an internal combustion engine to improve catalytic converter performance, comprising:

- dithering the equivalence ratio (Φ) about an equivalence ratio setpoint (stoichiometry);
- controlling the equivalence ratio with an oxygen sensor (30); and
- introducing a fuel enrichment pulse to sweep the equivalence ratio across stoichiometry (line 46 of column 10 to line 7 of column 11).

Re claims 4 and 8, in the method of Bush et al., the fuel enrichment pulse is added periodically.

Re claims 5 and 9, the method of Bush et al. further comprises determining the equivalence ratio of the internal combustion engine using an oxygen sensor (28 or 30).

Re claims 6, 10, and 11, in the method of Bush et al., the oxygen sensor generates a discrete analog signal.

Re claim 12, as shown in Figure 1, Bush et al. disclose an engine control system for an internal combustion engine, comprising:

- a fuel injector (22) for introducing fuel into the internal combustion engine;
- a controller (10) for controlling the amount of fuel injected into the internal combustion engine by the fuel injector;
- an exhaust manifold (32) coupled to the internal combustion engine; and
- a catalytic converter (34) coupled to the exhaust manifold;

wherein the controller dithers the equivalence ratio (Φ) about stoichiometry and introduces a fuel enrichment pulse to periodically sweep the equivalence ratio across stoichiometry (line 46 of column 10 to line 7 of column 11).

Re claim 16, in the system of Bush et al., the catalytic converter (34) is a three-way catalytic converter.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bush et al. as applied to claim 1 above, in view of legal precedent.

The method of Bush et al. discloses the invention as cited above, however, fails to disclose that the step of varying an equivalence ratio setpoint between a rich and a lean state characterized as a periodic function comprises varying the equivalence ratio between 0.9 and 1.1.

Bush et al. disclose the claimed invention except for specifying an optimum range of an equivalence ratio between 0.9 and 1.1. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a specific optimum range of equivalence ratio, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

7. Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bush et al. as applied to claim 12 above.

The system of Bush et al. discloses the invention as cited above, however, fails to disclose that the internal combustion engine is at least one of an overhead valve engine, an overhead cam engine, and a rotary engine.

Some of the internal combustion engines for vehicles are designed to be of the rotary type to improve engine performance because of the absence of end-of-excursion power loss as the movable parts in rotary engines do not reverse direction. Other engines are configured with overhead cam or valve to achieve a compact engine and to improve volumetric efficiency. Therefore, such disclosures by Bush et al. are notoriously well known in the art so as to be proper for official notice. It would have been obvious to one having ordinary skill in the art at

the time of the invention was made, to have configured the engine of Bush et al. to be of at least one of an overhead valve engine, an overhead cam engine, and a rotary engine, since the use thereof is routinely utilized by most workers in the art of internal combustion engines for vehicles.

8. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hepburn et al. (U.S. Patent 5,974,788).

Re claims 1, 7, and 12, as shown in Figures 1, 3, and 4, Hepburn et al. disclose a method of controlling the equivalence ratio in an internal combustion engine to improve catalytic converter performance and an engine control system for the engine, the system comprising:

- a fuel injector (16) for introducing fuel into the internal combustion engine;
- a controller (20) for controlling the amount of fuel injected into the internal combustion engine by the fuel injector;
- an exhaust manifold (22) coupled to the internal combustion engine;
- a catalytic converter (32) coupled to the exhaust manifold; and
- an oxygen sensor (36) coupled to the catalytic converter;

wherein the controller dithers the air-fuel ratio about stoichiometry based on the oxygen sensor and introduces a fuel enrichment pulse to periodically sweep the air-fuel ratio across stoichiometry (see Table 1 and lines 8-39 of column 3).

Hepburn et al., however, fail to disclose that instead of the air-fuel ratio, the controller dithers the equivalence ratio about stoichiometry.

Hepburn et al. disclose the claimed invention except for utilizing equivalence ratio as an indicator of an exhaust gas property. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use equivalence ratio in Hepburn et al., since the

examiner takes Official Notice of the equivalence of “air-fuel ratio” and “equivalence ratio” for their use in the exhaust gas treatment art (i.e., equivalence ratio is simply the ratio of stoichiometric air-fuel ratio (i.e., 14.7) and an air-fuel ratio of an air fuel mixture), and the selection of any of these known equivalents would be within the level of ordinary skill in the art.

Re claims 2 and 3, in the method of Hepburn et al., the step of varying an equivalence ratio setpoint between a rich and a lean state characterized as a periodic function comprises varying the equivalence ratio between 0.9 and 1.1 (from curve A in Figure 3, with an A/F Amplitude of approximately 1, the equivalence ratio is between 0.94 and 1.07).

Re claims 4 and 8, in the method of Hepburn et al., the fuel enrichment pulse is added periodically (from Table 1, the fuel enrichment pulse is added periodically after every 10 lean events).

Re claims 5 and 9, the method of Hepburn et al. further comprises determining the equivalence ratio of the internal combustion engine using an oxygen sensor (28).

Re claims 6, 10, and 11, in the method of Hepburn et al., the oxygen sensor generates a discrete analog signal.

Re claim 16, in the system of Hepburn et al., the catalytic converter (32) is a three-way catalytic converter (the NOx trap (32) in Hepburn et al. has a three-way function to purify NOx, CO, and HC in the exhaust gas).

Re claims 13-15, the system of Hepburn et al. discloses the invention as cited above, however, fails to disclose that the internal combustion engine is at least one of an overhead valve engine, an overhead cam engine, and a rotary engine.

Some of the internal combustion engines for vehicles are designed to be of the rotary type to improve engine performance because of the absence of end-of-excursion power loss as the movable parts in rotary engines do not reverse direction. Other engines are configured with overhead cam or valve to achieve a compact engine and to improve volumetric efficiency. Therefore, such disclosures by Hepburn et al. are notoriously well known in the art so as to be proper for official notice. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have configured the engine of Hepburn et al. to be of at least one of an overhead valve engine, an overhead cam engine, and a rotary engine, since the use thereof is routinely utilized by most workers in the art of internal combustion engines for vehicles.

Prior Art

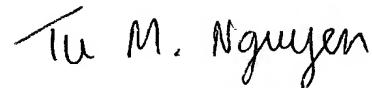
9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of three patents: Mamiya et al. (U.S. Patent 5,462,039), Adamczyk et al. (U.S. Patent 5,974,790), and Yamashita (U.S. Patent 6,311,482) further disclose a state of the art.

Communication

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (703) 308-2833.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (703) 308-2623. The fax phone number for this group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-1148.



TMN

Tu M. Nguyen

June 13, 2004

Patent Examiner

Art Unit 3748